ABSTRACT

In a turbo-retarder oil is admitted to the rotor through a centrifugally controlled valve to regulate the value of the resistance torque exerted on the rotor shaft. The valve member is axially movable by a fork having springs interposed between the fork and the valve tending to move the valve to the open position. A plurality of inertia members are carried by the rotor shaft and bear on a radially inwardly directed conical surface of the valve so that the valve will be moved toward the closed position as the inertia members are moved radially outward under centrifugal force.

3 Claims, 5 Drawing Figures
REGULATION DEVICE FOR HYDRAULIC TURBO-RETARDERS

BACKGROUND OF THE INVENTION

The present invention relates to a regulation device for hydraulic turbo-retarders, which operate through centrifugal action, and are used, in particular, in motor vehicles.

Owing to its mode of operation, such a turbo-retarder produces a torque of resistance which increases rapidly as a function of its speed of rotation, according to a parabolic curve. The torque of the retarder is therefore characterized in that:

- below a certain speed of rotation, the slowing down effect produced remains very low, and, in any case, inadequate;
- on the other hand, beyond a certain speed threshold, the slowing down torque reaches exaggerated values, which result in jerks in the operation and may even cause ruptures in the gear transmission on a motor vehicle.

SUMMARY OF THE INVENTION

The object of the invention is to obviate such drawbacks by providing the turbo-retarder with a regulation device which, above a threshold corresponding to a comparatively low speed, ensures a torque of resistance of a substantially constant value.

A regulation device according to the invention is intended to be fitted to a turbo-retarder into which oil is fed through an axial opening in a fixed deflector, and reaches the rotor of the apparatus, which rotor then centrifugates said oil towards fixed slowing down vanes. Said regulation device is characterized in that it includes a coaxial shutter valve adapted to move with respect to the annular oil inlet seat to open or close same, said valve being urged back against its fixed seat, that is, in a closing direction, by a sliding fork, while, in the opening direction the instantaneous location of said valve is defined by the equilibrium between two antagonist forces, that is, on the one hand, the thrust of at least one spring interposed between the fork and the valve, which spring tends to open said valve, and, on the other hand, the thrust of inertia blocks bearing on a hub secured to the rotary shaft of the rotor, so that said blocks may be urged by centrifugal force against a conical ramp inside which they bear against the valve and tend to close same as the speed of rotation increases.

According to another feature of the invention, the inertia blocks are constituted by mere balls which roll between a shaped bearing on the hub of the rotor shaft and an inner frusto-conical bearing in the valve, said latter bearing converging towards the rotor.

According to an additional feature of the invention, the sliding fork is also acted upon by resilient return means which, in its inoperative position, tend to return said for till the valve is completely closed. Another feature of the invention consists in using a valve which cannot rotate but is adapted to slide in axial direction on a fixed bearing, the peripheral supporting wall of which has a barrel-like profile, so as to prevent any jamming by the valve being disaligned.

The appended drawings are given by way on non-limiting example only, in order further to illustrate the particular features of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial sectional view of a turbo-retarder according to the invention;

FIGS. 2 and 3 illustrate two different positions of the regulation valve;

FIG. 4 is a diagram illustrating the theoretical operation of the turbo-retarder;

FIG. 5 shows a modified embodiment of the regulation valve.

DETAILED DESCRIPTION OF THE INVENTION

With reference to the drawing, the turbo-retarder includes a fixed case 1, a radiator 2, a piping 3 for the discharge of the hot oil, a piping 4 for the return of cooled oil, a ventilator 6 keyed to a rotary shaft 7 carried by the rotor 20 of a centrifugal pump. Oil is admitted to the rotor 20 through an annular seat 35 provided on a fixed distributor 18 about the shaft 7. A closing valve 36 adapted to slide axially (double arrow 101) is capable of closing the seat 35 to a variable extent, so as to regulate the oil flow to the rotor 20, that is, regulate the valve of the slowing down torque exerted on the rotary shaft 7.

The present invention consists in interposing at least one spring 102 between the rear flange 103 of the valve 36 and the fork 39 controlling said valve, the latter being, besides, provided with an inner frusto-conical outline 104 upon which the balls 105 bear. The balls 105 bear also on the transverse surface 106 of a hub 107 keyed to the shaft 7. Thus, when the shaft 7 and the hub 107 rotate, the effect of centrifugal force tends to push away the balls 105, so that said balls climb along the outline 104 and tend to cause the valve 36 to close (FIG. 2, arrow 108). Such action takes place against the springs 102, whereby said action is allowed to develop even in the case of the fork 39 remaining stationary.

Lastly, a shoulder 109 is provided on the valve 36 forward of the fork 39, which is thus able to abut against said shoulder in order positively to ensure the closing of the valve 36 on the seat 35 thereof.

A spring 41 may be provided on the sliding rod 33 of the fork 39 so as to bring said fork back against the shoulder 109 while keeping the valve 36 in its closed condition.

Finally, according to a further feature of the invention, a revolution cylindrical wall 110 is provided inside the valve 36, and is adapted to slide on a fixed annular support 111, the cross-section of which is barrel-shaped, so as to cut out any risk of jamming due to a misalignment of the valve 36 with respect to the shaft 7.

The operation is as follows:

To set the turbo-retarder to work, the operator operates the rod 33 by pulling same in the direction of the arrow 112. Since the valve 36 is thus fully opened, the slowing down torque C generated on the shaft 7 increases rapidly as a function of the speed of rotation N of said shaft (curve O A in FIG. 4). Beyond a certain speed threshold Nₐ, the effect of centrifugal force on the balls 105 overcomes the resilient reaction of the spring 102 and causes the valve 36 to close partially by moving in the direction of the arrow 113 (FIG. 3), although the fork 39 remains stationary. The valve of the torque of resistance C varies then according to the law illustrated by the section A-B, that is, in an asymptotic
way with respect to a constant value $C_t$ of the torque $C$.

It will be appreciated that, by selecting judiciously the loads for the springs and the dimensions of the various parts of the regulator for the valve 36, it is possible to reach the threshold $A$ very quickly, that is, with a speed of rotation $N_t$ comparatively low. Beyond said threshold, the turbo-retarder provides a substantially constant torque of resistance (curve A-B).

In a turbo-retarder of the previous art, on the contrary, the torque was varying according to a substantially parabolic curve (curve O-D-E in FIG. 4), so that the value of such torque was definitely insufficient at low speeds, while it was reaching unduly high levels at high speeds.

In the modified embodiment illustrated in FIG. 5, the fork 39 is mounted without any play in the shoulder 109 on the valve 36. The return spring 41 for the closing of the valve bears on a shoulder 114 on the rod 33. A single spring 102 is used, which is compressed between an end shoulder or holding ring on the rod 33 and the fork 39, the latter moving freely along the rod 33 by means of a sleeve 116 housed between the shoulders 114 and 115.

It will be seen that, should the centrifugal force from the balls 105, as converted into an axial force through the conical bearing 104 on the valve 36, be higher than the initial loading force on the spring 102, the operator compresses the latter by pulling the rod 33 in the direction of the arrow 112. In the opposite case, the fork 39 and the valve 36 are moved backwards.

When the positive thrust of the valve 36 on its seat is provided by the spring 41 pushing the rod 33 which acts in turn on the fork 39, it is necessary to provide a travel arresting device rearwards, which may be the spring 41 ending in joined coils, or an adjustable stop (not shown) screwed in the case 1.

What is claimed is:

1. A hydraulic turbo-retarder comprising a fixed fluid housing having a centrifugal chamber therein, a rotary shaft extending through said housing, a plurality of radially outwardly directed vanes secured to said shaft, said housing having a plurality of radially inwardly directed blades disposed adjacent said vanes, fluid passage means in said housing for supplying fluid to the ends of said vanes adjacent said shaft, valve means for controlling the flow of fluid from said fluid passage means to said vanes comprising an annular hub secured to said housing and surrounding said shaft adjacent said vanes, a portion of said housing being spaced radially outwardly from said hub adjacent the radially innermost ends of said vanes and an annular valve member slidably mounted on said hub for movement into and out of engagement with said portion of said housing, first operating means for shifting said annular valve member axially along said hub comprising a pin slidably mounted in said housing and disposed parallel to said shaft and lost motion spring connection means between said pin and said annular valve member and second operating means comprising a plurality of radially movable inertia members disposed radially inwardly of said annular valve member, conical ramp means on said annular valve member extending inwardly toward said shaft and guide means secured to said shaft for guiding said inertia members for radial movement while disposed in engagement with said conical ramp.

2. A hydraulic turbo-retarder as set forth in claim 1 wherein said lost motion spring connection means is comprised of a shifting fork having one end secured to said pin with the other end disposed in straddling sliding engagement with said annular valve member, a pair of spaced-apart abutment means disposed on said annular valve member on opposite sides of said fork to limit the relative sliding movement between said fork and said annular valve member, first spring means on said annular valve member for biasing said fork into engagement with the abutment means closest to said portion of said housing and second spring means for biasing said pin and fork toward said portion of said housing.

3. A hydraulic turbo-retarder as set forth in claim 1 wherein said lost motion spring connection means comprises a shifting member secured at one end to said annular valve member with the opposite end disposed in sliding engagement on said pin, a pair of spaced-apart abutment means on said pin for limiting the sliding movement of said shifting member relative to said pin, first spring means on said pin member for biasing said shifting member into engagement with said abutment means furthest from said portion of said housing and second spring means on said housing for biasing said pin toward said portion of said housing.

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